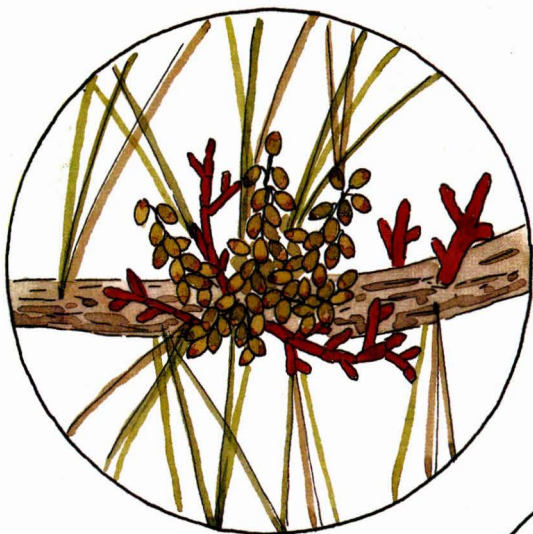


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A GUIDE TO MISTLETOES

of ARIZONA and NEW MEXICO



Southwestern Region
U.S. Department of Agriculture
Forest Service

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A GUIDE TO MISTLETOES

of Arizona and New Mexico

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INTRODUCTION

The mistletoes are parasitic plants that have a harmful effect on their woody hosts. The two types of mistletoe found in Arizona and New Mexico are dwarf mistletoe (**Arceuthobium** sp.) and true mistletoe (**Phoradendron** sp.). The dwarf mistletoes parasitize only coniferous trees, while true mistletoes infect conifer and hardwood trees and shrubs. As parasites, mistletoes compete with their host for nutrients and water taken up or synthesized by their hosts. This competition results in reduced host vigor, which often makes the tree more susceptible to other diseases and/or insects and sometimes causes death of the tree. Thus, the effects of mistletoe on its host become an important consideration for both the land manager and homeowner.

Objective

The objective of this paper is to provide a guide to mistletoes found in Arizona and New Mexico. Recognition and subsequent identification of the casual organism is the first step in obtaining a better understanding of any disease problem. Information relative to mistletoe distribution, damage, and hosts is included in this guide. General principles of mistletoe control also are given.

Dwarf Mistletoes

In Arizona and New Mexico, there are eight species of dwarf mistletoe infecting coniferous tree species. The biology of these parasitic plants has received extensive coverage by Hawksworth and Wiens (1972) and, therefore, will not be repeated here. Research results have established the detrimental effects of various dwarf mistletoe species on their hosts (Baranyay 1972, Hawksworth 1961, Hawksworth and Graham 1963). Dwarf mistletoe reduces the growth rate, vigor, cone and seed production, seed viability, and merchantability of heavily-infected trees. Also, mortality rates for heavily-infected trees are higher than for non-infected trees (Hawksworth and Wiens 1972).

Symptoms of dwarf mistletoe infection often include swelling of the branch at an infection site, formation of a resin-soaked canker at an infection site on the bole, and formation of witches' brooms. Witches' brooms are dense clusters of branches that may result from infection by dwarf mistletoe or from several other factors. Figures 1-4 show

typical symptoms caused by dwarf mistletoe infections. Symptoms of dwarf mistletoe infection may vary with the mistletoe species and the host species.

Control of dwarf mistletoe can be accomplished by cultural treatment of infected trees. Within the forest stand, cultural operations such as thinning and removal of infected residual trees are accepted control operations. Treatment of ornamental or high-value trees infected with dwarf mistletoe may include pruning infected branches and removal of heavily-infected trees. In determining the level of dwarf mistletoe infection in a tree, the 6-class mistletoe rating system is used (Hawksworth 1977) (Fig. 23). Trees with dwarf mistletoe ratings of 4, 5, or 6 are considered heavily infected. Failure to remove heavily-infected trees will result in spread of dwarf mistletoe to nearby trees of the same species, eventually causing deterioration of such trees.

Hawksworth, Stewart, and Bailey (1968) provide the following pruning guide for dwarf mistletoe-infected ponderosa pine: "Branches 1.0 inch in diameter may be pruned if shoots do not occur closer than 6 inches from the bole. For each 1-inch increase in branch diameter, the minimum safe distance is increased by 2 inches." Hawksworth (1961) provided additional information relative to control of dwarf mistletoe on ponderosa pine. Guidelines for control of dwarf mistletoe on ponderosa pine may be applied in general to other tree species infected with various dwarf mistletoes of the Southwest.

Figures 5-12 and Table 1 provide information on identification, hosts, and distribution of dwarf mistletoes in Arizona and New Mexico. Dwarf mistletoes of the Southwest can be most easily identified by determining their host and geographic location of the host. Although some mistletoes may infect trees other than their principal host, generally, identification of the host and location will provide an adequate basis for identifying the dwarf mistletoe species. Personnel from the Forest Insect and Disease Management Staff Unit in Albuquerque will provide assistance in identifying host-parasite combinations not listed in Table 1. Little's (1950) guide to native trees in New Mexico and Arizona will help identify host trees.

True Mistletoes

Seven species of true mistletoe occur on trees and shrubs in Arizona and New Mexico. Three true mistletoes commonly infect various species of hardwood trees and shrubs, while the remaining four

species infect coniferous trees. The biology of true mistletoes occurring on hardwoods has been outlined by Scharpf and Hawksworth (1974).

Figure 24 summarizes several features that differentiate the true and dwarf mistletoes. True mistletoes are generally leafy plants, while the dwarf mistletoes have no leaves. The two exceptions to this characteristic are **Phoradendron juniperinum** and **P. californicum**, which are leafless species of true mistletoe. A second differentiating character is the size of the mistletoe plant. Dwarf mistletoe plants vary in size from bud-like protrusions to shoots of nearly 1 foot in length. True mistletoe shoots vary from about 6 inches to several feet in length. A third differentiating character is the method of seed dispersal. True mistletoe seeds are disseminated by birds that feed on the berries of the mistletoe plant. Mistletoe seeds pass through the avian digestive tract and are disseminated in the feces. Dwarf mistletoe plants have explosive fruits which propel seeds into the surrounding area. Finally, true mistletoes, although parasitic, produce much of their own food and depend on their host mainly for water and minerals. Thus, the true mistletoes have less harmful effects on their host than dwarf mistletoes.

Effects on the host tree or shrub infected with true mistletoe may take several forms. Heavily-infected trees have reduced growth rates and often are predisposed to other insect or disease problems. Swellings often occur at infection sites and heavily-infected branches may be broken during windstorms or snowstorms (Scharpf and Hawksworth 1974). True mistletoes on conifers have more severe effects on their host than those on hardwoods and may result in death of their host.

Control of true mistletoes in forest stands is seldom practiced because the primary hosts are noncommercial tree species. However, high-value trees on homesites or in recreation areas may be pruned to reduce competition between mistletoe and the host. Removal of heavily-infected trees also provides a means of mistletoe suppression. Temporary reduction in spread of mistletoe may be accomplished by breaking off mistletoe shoots. This procedure would require repetition at 2- to 3-year intervals (Scharpf and Hawksworth 1974).

True mistletoe species on hardwoods can be identified by determining their host. The conifer-infecting true mistletoes cannot be identified to species by host determination, with the exception of **P. bolleanum** subsp. **pauciflorum**, which occurs only on white fir. Characteristics

of the mistletoe plant differentiate the remaining three species of true mistletoe. The identifying character of **P. juniperinum** is the absence of leaves on the plant. **P. bolleanum** subsp. **densum** has smooth-surfaced leaves, while the leaf surface of **P. capitellatum** is quite hairy. Figures 13-22 and Table 2 provide further information relative to identification, hosts, and distribution of true mistletoes in Arizona and New Mexico. The map on the back cover shows the location of National Forests in Arizona and New Mexico.



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Table 1.—Principal hosts and distribution of dwarf mistletoes in Arizona and New Mexico.¹

Dwarf mistletoe species	Common name	Principal hosts	Distribution by National Forest
Arceuthobium vaginatum subsp. cryptopodum	Southwestern dwarf mistletoe	Ponderosa pine	All
Arceuthobium apachecum	Apache dwarf mistletoe	Southwestern white pine	Apache-Sitgreaves, Cibola, Coronado, Gila, Lincoln
Arceuthobium blumeri	None	Southwestern white pine	Coronado
Arceuthobium gillii	Chihuahua pine dwarf mistletoe	Chihuahua pine	Coronado
Arceuthobium divaricatum	Pinyon dwarf mistletoe	Pinyon Single-leaf pinyon	All, except Coronado
Arceuthobium douglasii	Douglas-fir dwarf mistletoe	Douglas-fir	All
Arceuthobium microcarpum	Western spruce dwarf mistletoe	Engelmann spruce Blue spruce Bristlecone pine	Apache-Sitgreaves, Coconino, Coronado, Gila, Kaibab
Arceuthobium abietinum f. sp. concoloris	White fir dwarf mistletoe	White fir	Coronado, Grand Canyon National Park

¹U.S. Dep. Agr., Forest Serv. Manual, R-3 Supplement No. 5, 1971, Sec. 5261; Hawksworth, F. G., and D. Wiens. 1972. Biology and classification of dwarf mistletoes (**Arceuthobium**). U.S. Dep. Agr. Handbook No. 401. 234 pp.; Mathiasen, R. L. 1976. Southern range extension of the white fir dwarf mistletoe in Arizona. Great Basin Naturalist 36(4): 461-462; Mathiasen, R. L. 1977. The taxonomy and epidemiology of dwarf mistletoes parasitizing white pines in Arizona. Ph.D. thesis, Univ. of Arizona. 90 p.

Table 2. — Principal hosts and distribution of true mistletoes in Arizona and New Mexico.¹

True mistletoe species	Principal hosts	Distribution by National Forest
Phoradendron tomentosum	At least 60 hardwood species, but not on oaks	Coconino, Coronado, Gila, Tonto
Phoradendron villosum	Various species of oak	Coconino, Coronado, Gila, Kaibab, Lincoln, Prescott, Tonto
Phoradendron californicum	Leguminous trees and shrubs	Coronado, Prescott, Tonto
Phoradendron bolleanum subsp. densum	Arizona cypress	Coconino, Tonto
Phoradendron juniperinum	One-seed juniper; Utah juniper; alligator juniper; Rocky Mountain juniper; red-berry juniper	All
Phoradendron capitellatum	Utah juniper; alligator juniper; red-berry juniper	Coconino, Coronado, Gila Prescott, Tonto
Phoradendron bolleanum subsp. pauciflorum	White fir	Coronado—only in Santa Catalina Mountains

¹Scharpf, R. E. and F. G. Hawksworth. 1974. Mistletoes on hardwoods in the United States. U. S. Dep. Agr., Forest Serv., Forest Pest Leaflet 147. 7 pp.; Wiens, D. 1964. Revision of the Acataphyllous species of **Phoradendron**. Brittonia 16: 11-54; Hawksworth, F. G., personal communication.



Fig. 1. — Branch swelling at dwarf mistletoe infection site caused by *A. vaginatum* subsp. *cryptopodum* on ponderosa pine (see arrow).



Fig. 2. — Bole canker caused by *A. vaginatum* subsp. *cryptopodum* infection on ponderosa pine; note resin flow and swelling of bole.



Fig. 3.—Numerous witches' brooms caused by *A. divaricatum* infections on pinyon pine; this tree died from heavy mistletoe infection.

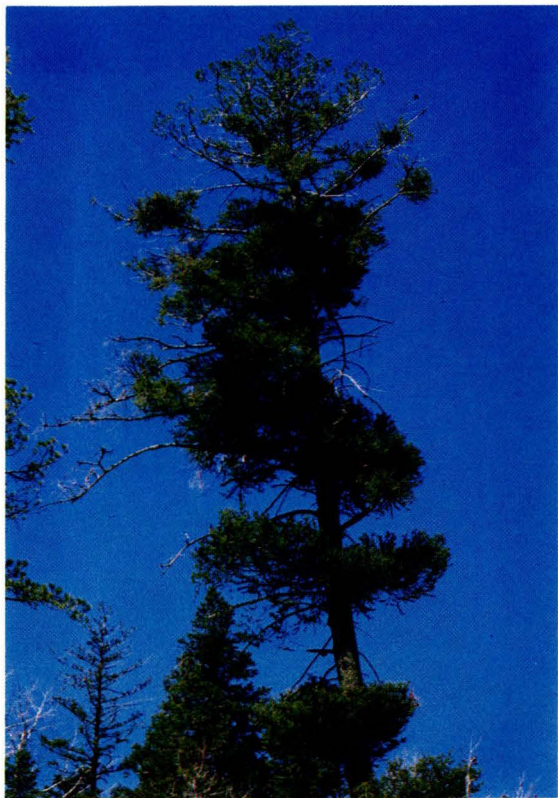


Fig. 4.—Witches' brooms caused by *A. douglasii* infections on a Douglas-fir tree.



Fig. 5.—*A. vaginatum* subsp. *cryptopodum* infecting a ponderosa pine branch.



Fig. 6.—*A. douglasii* infecting a Douglas-fir branch; note the small size of mistletoe shoots, usually shorter than the needles.



Fig. 7.—*A. apachecum* infecting a southwestern white pine branch.



Fig. 8.—*A. divaricatum* infecting a pinyon pine branch.



Fig. 9.—**A. microcarpum** shoots on the underside of an Engelmann spruce branch; note swelling of the branch at an infection site (see arrow).



Fig. 10.—**A. microcarpum** infecting a bristlecone pine branch.



Fig. 11.—*A. abietinum* f. sp. *concoloris* on a white fir branch; note the numerous dwarf mistletoe fruits (see arrow); seeds are contained in these explosive fruits.



Fig. 12.—*A. gillii* infecting a Chihuahua pine branch.

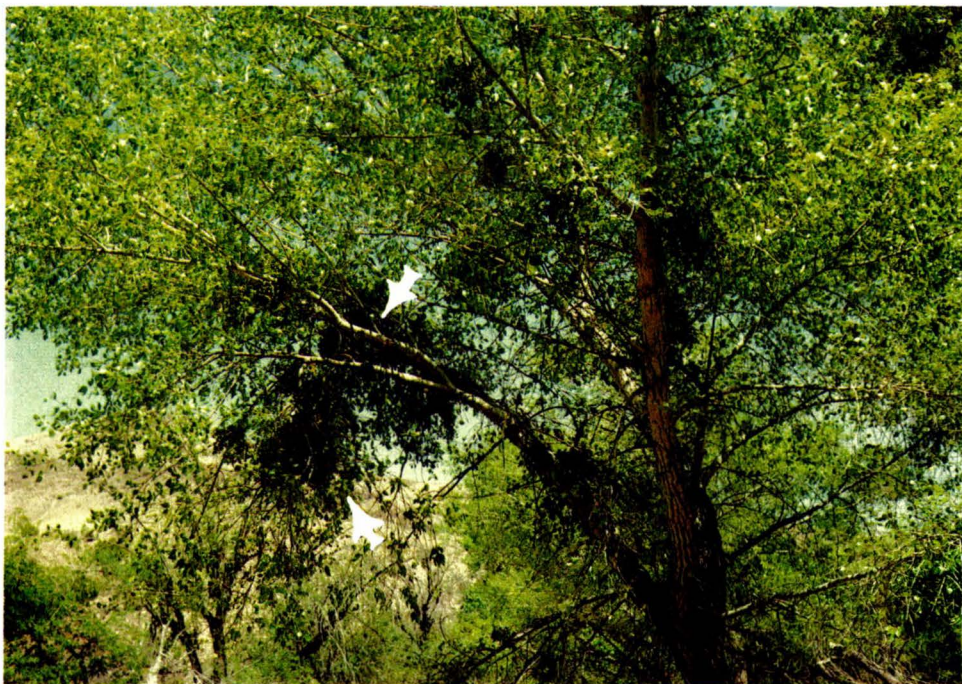


Fig. 13.—*P. tomentosum* plants on a cottonwood tree (see arrows).



Fig. 14.—*P. tomentosum* infecting a cottonwood branch; note the swelling and distortion of the infected branch.



Fig. 15.—Several *P. villosum* plants on an oak tree.



Fig. 16.—*P. villosum* plant on an oak branch; note large size and dense nature of mistletoe shoots.



Fig. 17.—*P. juniperinum* plants infecting a juniper tree; note the large number and rounded appearance of mistletoe plants (see arrow).



Fig. 18.—*P. juniperinum* plants on juniper branches; note the absence of leaves on the mistletoe plant.



Fig. 19.—*P. capitellatum* plants on a juniper tree (see arrows).

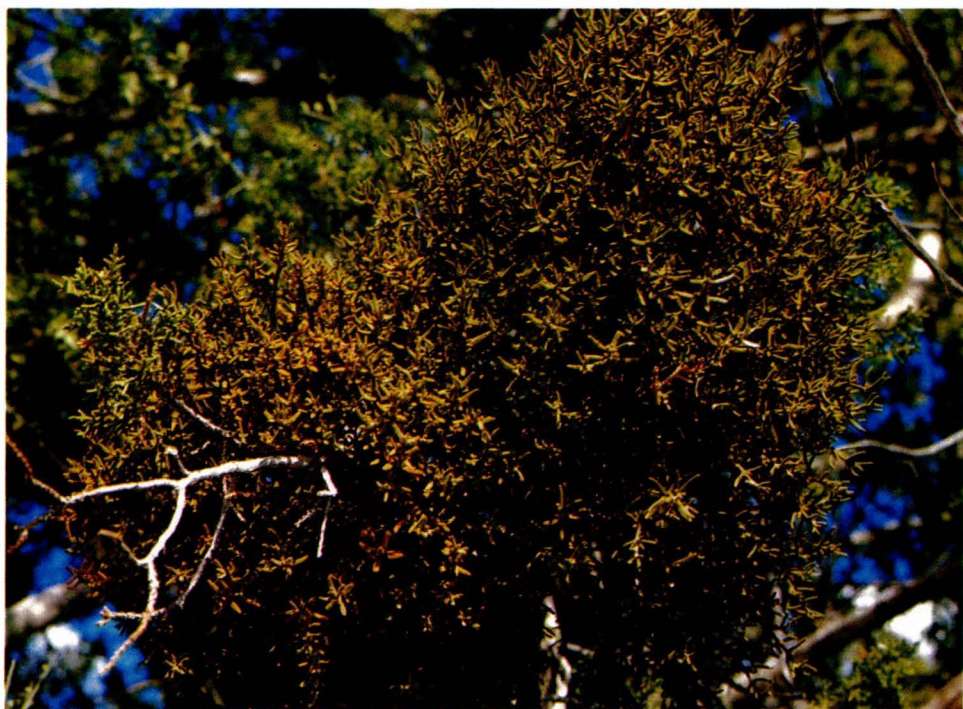


Fig. 20.—*P. capitellatum* plants on a juniper branch; note small size of leaves and color variation between the two plants.



Fig. 21.—*P. californicum* plant on a mesquite tree.



Fig. 22.—*P. bolleanum* subsp. **pauciflorum** on a white fir branch.

6-CLASS DWARF MISTLETOE RATING SYSTEM.

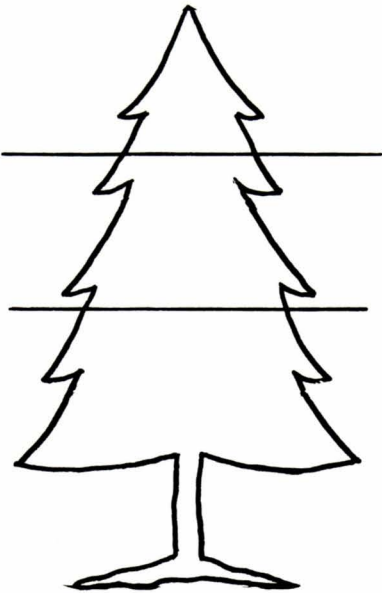
Instructions

STEP 1: DIVIDE LIVE CROWN INTO THIRDS.

STEP 2: RATE EACH THIRD SEPARATELY. EACH THIRD SHOULD BE GIVEN A RATING OF EITHER 0, 1, OR 2 AS DESCRIBED BELOW.

- (0) No visible infections
- (1) Light infection ($\frac{1}{2}$ or less of total number of branches in the third infected)
- (2) Heavy infection (more than $\frac{1}{2}$ of total number of branches in the third infected)

STEP 3: ADD RATINGS OF THIRDS TO OBTAIN RATING FOR TOTAL TREE.



Example

If this third is lightly infected, its rating is (1)

If this third is lightly infected, its rating is (1)

If this third is heavily infected, its rating is (2)

AND THE TREE, IN THIS EXAMPLE, WILL RECEIVE A RATING OF 4 (class 4 tree)

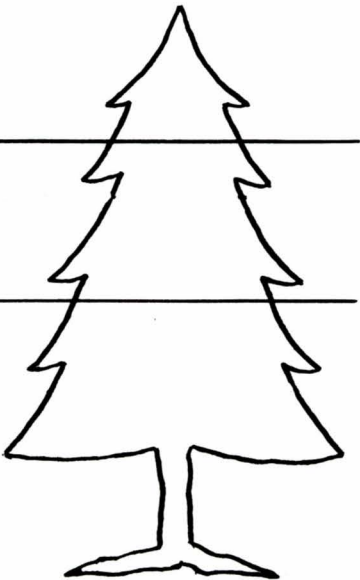


Fig. 23

A SUMMARY OF THE FEATURES

DIFFERENTIATING

DWARF AND TRUE MISTLETOES.

Dwarf mistletoes

1. Mistletoe plant is leafless.
2. Mistletoe shoots from less than 1 inch to 12 inches in length.
3. Seeds propelled from explosive fruits.
4. Few required nutrients produced by mistletoe plant.
5. Cross-section of stem is not woody.

True mistletoes

1. Mistletoe plant has leaves (except ***P. juniperinum*** and ***P. californicum***).
2. Mistletoe shoots from 6 inches to about 3 feet in length.
3. Seeds not explosive; disseminated by birds.
4. Substantial portion of required nutrients produced by mistletoe plant.
5. Cross-section of stem is woody.

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